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ABSTRACT

This issue of the newsletter describes the five Soloworks Laboratories which are being developed in conjunction with Project Solo. These are: 1) The Computer Laboratory, focusing on those aspects of mathematics which are well described by algorithms and which encourage student access to a local computer and terminals; 2) the Dynamics Laboratory, which deals with mathematical processes that take place in time; 3) the Logical Design Laboratory, involving digital and analog circuit modules; 4) the Synthesis Laboratory, which is concerned with that type of mathematical analysis which makes use of the principle of superimposition, of producing complex effects by adding together simple ones; and 5) the Modelling/Simulation Laboratory, which uses mathematics as a tool for the creation of new models of reality. (PB)

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SOLO WORKS

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Newsletter #24 December 7, 1973

THIS ISSUE OF THE NEWSLETTER DESCRIBES THE FIVE SOLOWORKS LABS

The Computer Lab

The Computer Lab will focus on those aspects of mathematics that are well described by algorithms, and encourage student access of a local computer and terminals. A major skill students will achieve in this lab is that of computer programmer. Examples of some projects that have already been done by students in this lab are developing programs to do accounting and inventory for a small store, programs to play all kinds of games, programs to simulate transportation systems, generation of random ballet dances, a program to interpret "macro" commands for a multi-media show, programs to plot all kinds of mathematical curves and predict and plot their intersections, etc. The significance of the project approach is that although students have made available to them past "heritage" appropriate to attacking the project, they are also expected to develop new and unique extensions of that heritage.

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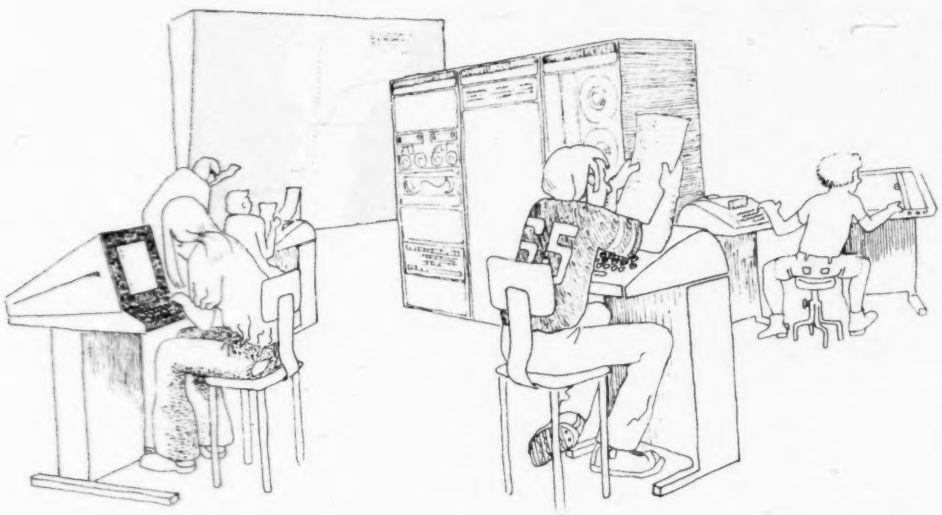

Most of the hardware for the computer lab is "off-the-shelf". A future newsletter will go into some detail about the hardware and software we are using, and the reasons for our choice.

Manufacturers who have shown genuine concern for the problems of education include DEC*, HP, Wang*, and Data General. Some newcomers may surface in the future; at present their products must be classified as experimental, albeit (albeit is one of our favorite words) exciting. An example is the Alto computer. (*means software compatible with extended Dartmouth BASIC.)

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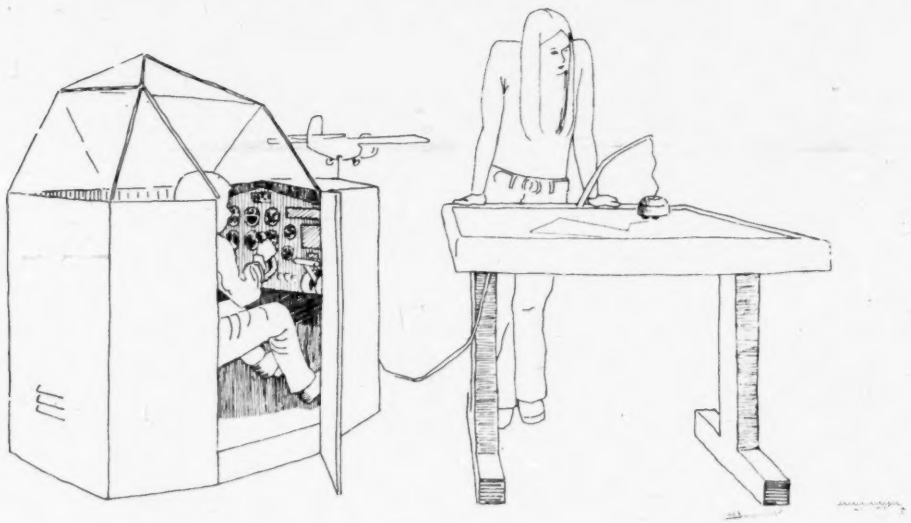
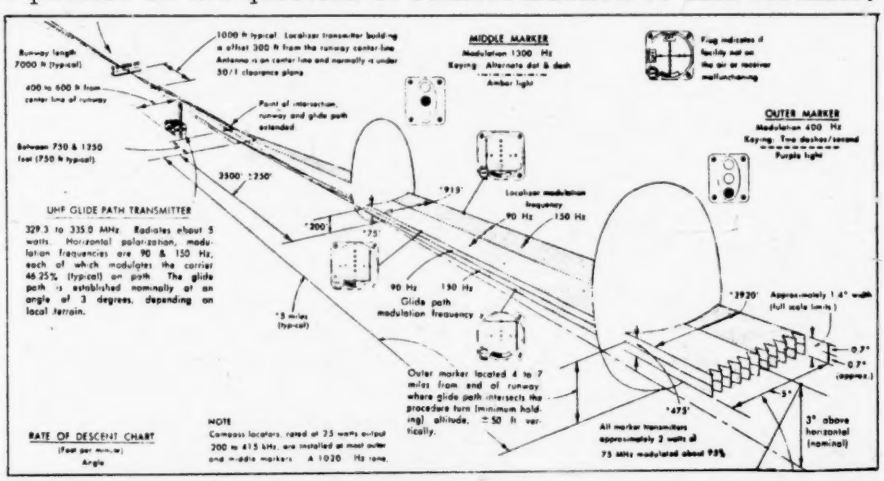
The Dynamics Lab

The Dynamics Lab focuses on mathematics that describes processes that take place in time. One form of technology to be used in this lab is a flight simulator. The skill acquired in using this particular equipment is that of making a full instrument landing, or becoming good at instructing a fellow student to do the same. An example of a project would be to sample analogue readings of heading, time, and speed from the flight simulator, translate these into digital data, and then write a program that plots the path of the flight simulator. Another type of artifact being considered for the Dynamics Lab is the "Rube Goldberg" machine, a gadget designed by the student to do nothing useful, but to be a mind-stretching exercise in imagination. Some other work will center on the use of mechanical ball or disc integrators. We think learning to work with the concept of "rate" can become a very natural thing for relatively young students; rate-of-change and integration are certainly classical examples of powerful mathematical ideas.

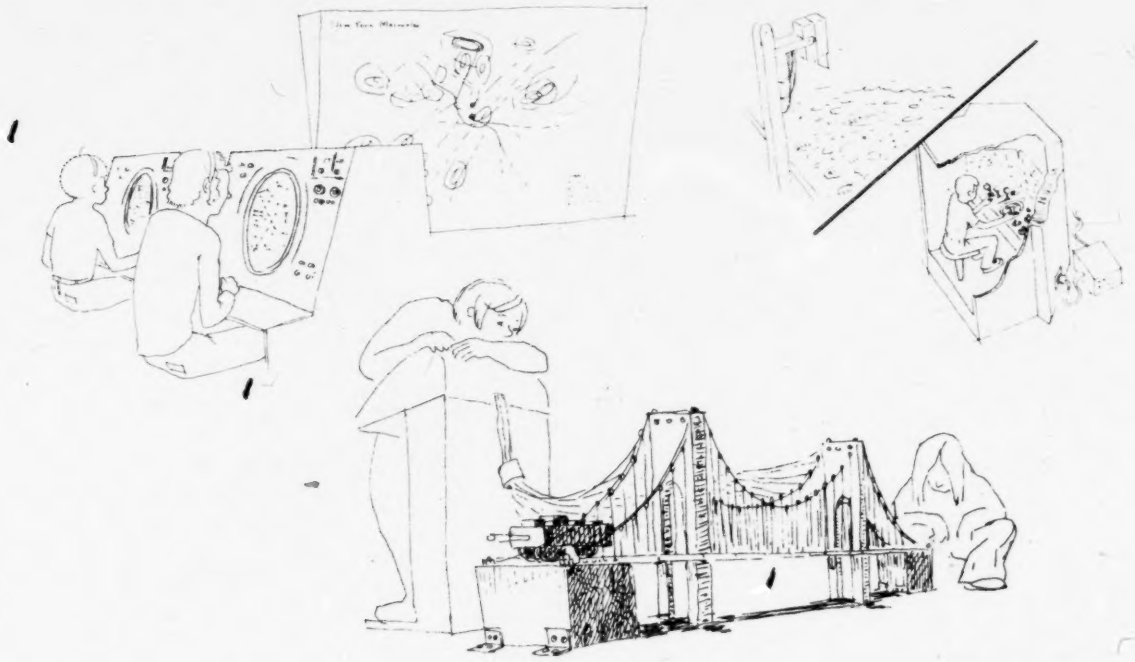


In order that other schools can use these same devices with any small computer, it is our intention to transmit data between computer and simulator (or other lab devices) in serial ASCII form. We welcome comments from interested parties on the question of standardization of data formats.

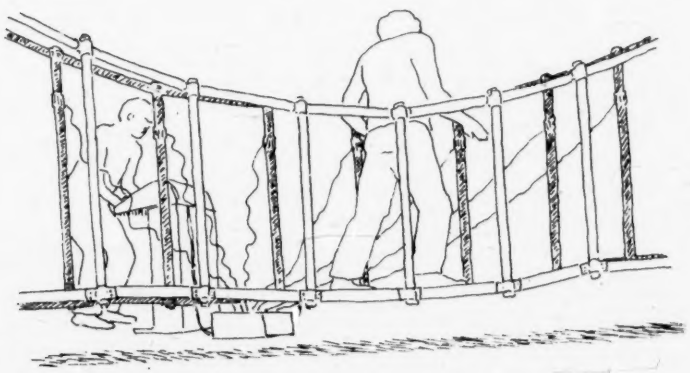


Modelling/Simulation Lab

The Modelling/Simulation Lab uses mathematics as a tool for creating new models of reality that can be studied and manipulated. Some of the models will be physical (e.g. bridges, elevators, lunar landing modules, etc.), some abstract (e.g. an ecology, an economy, etc.). The skill developed here is really that of applied mathematician, while the gamut of possible projects is open-ended. This is because the computer available to students is general purpose, allowing them to simulate systems not heretofore dealt with. Good software is essential too, which is why we are looking into a language like BASIC PLUS.

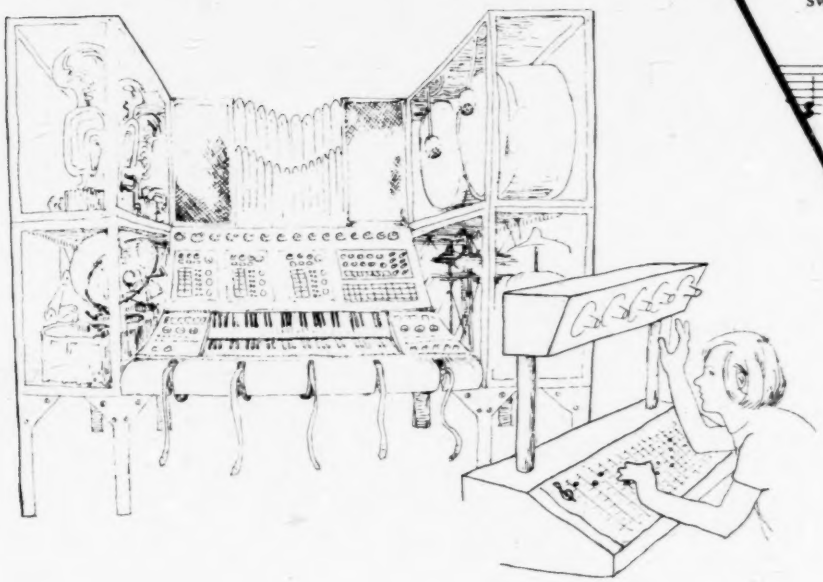
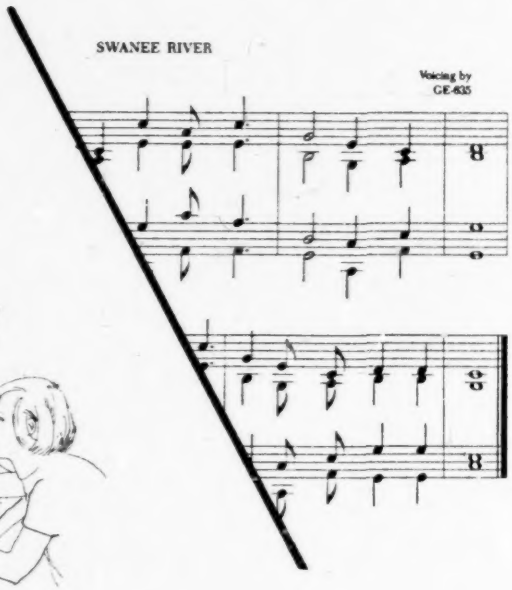


The Rube Goldberg machines also fall into this lab (although we're not sure what they simulate!). Perhaps it's semi-accurate to say that they model a fertile imagination. Incidentally, the best model-building sets seem to come from abroad (Automat and Meccano). A really good junk pile seems to be essential.

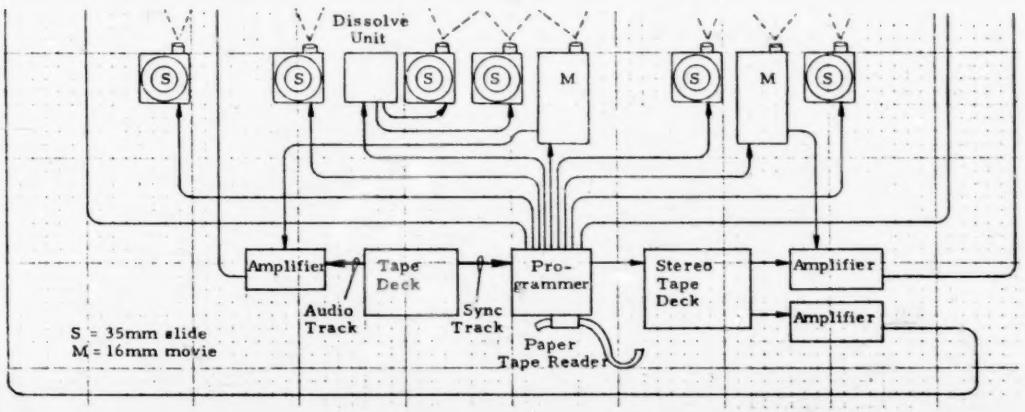


Synthesis Lab

The Synthesis Lab is concerned with mathematical analysis that makes use of the principle of superimposition, producing complex effects by adding together simple ones. Two special pieces of technology we will use are the "Music Monster" (a kind of programmable band-organ), and a multi-media programmer together with suitable projection equipment. The obvious skills associated with these devices are composer and media-designer. Projects will focus on the design, degugging, and performing of original works.



Our initial forays into the music field have been in terms of real organ pipes to be run under program control. Next we'll look at a modularly designed synthesizer. This later technology is replete with applications of the concepts of function, algebraic products and sums, periodicity, summation of series, local linearity, transforms, etc.



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OUR FIRST MULTI-MEDIA SPECTACULAR IS CALLED:

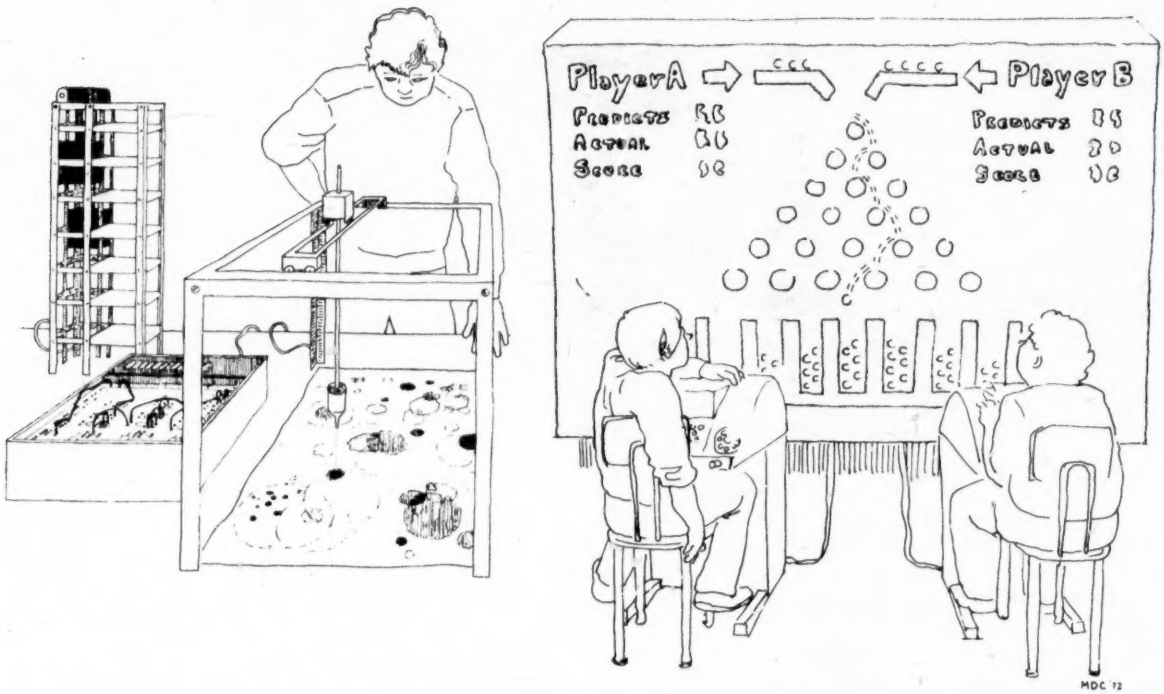
MIDNIGHT TO MIDNIGHT

FOR FURTHER NEWS, WATCH THIS SPACE.

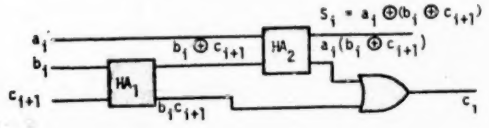
Logical Design Lab

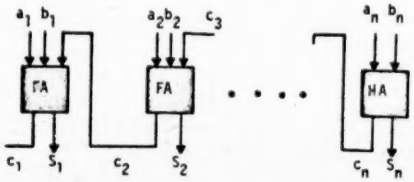
The Logical Design Lab is a new idea which practically forced itself on us as a consequence of wanting to do significant things in the other labs. The technology used will be digital and analogue circuit modules. We're tempted to call the skill involved "electronic wizardry". One of the most amazing things about this lab is that one really does have to use such things as associative and commutative laws (e.g. to simplify the Boolean equations describing a circuit so that it can be built with a reasonably small number of parts). Projects will include light trees, color organs, cryptography machines, burglar alarms, foolproof control systems for the other projects (e.g. the elevator below), computer-to-lab-device interfaces, etc.

Another area we will include in this lab is suggested by intense interest in stereo and quadraphonic sound we have noted in young people today. Phrases like "matrix decoder" are known to them, and of great interest. But they don't have the slightest idea how these things work. We intend doing something about that, and math will be front stage and center in the explanations.



We would like to eventually come up with some ideas on a kit of logic modules, amplifiers, etc., that takes advantage of recent strides in IC (Integrated Circuit) technology. Such technology is becoming very low cost. We also think the "visible" logic of relays and mechanical linkages should be included.





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SOLOWORKS To keep posted about future developments at soloworks, just print your name, address, and zip on the enclosed mailing label, and send it back to Project Solo, 812 Cathedral of Learning, Pittsburgh, Pa. 15260.

THE ONLY WAY TO GET THE NEXT SOLOWORKS NEWSLETTER IS TO SEND US BACK A FILLED-IN MAILING LABEL. WE'D ALSO LIKE TO KNOW WHAT YOUR INTEREST IN COMPUTERS AND EDUCATION IS, WHAT KIND OF HARDWARE AND SOFTWARE YOU USE, AND WHICH OF THE LAB DEVICES (IF ANY) ARE OF PARTICULAR INTEREST TO YOU. THIS LAST PIECE OF INFORMATION WILL HELP US SET PRIORITIES IN DEVELOPING CURRICULUM MATERIALS.

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Hewlett Packard Curriculum Project
11000 Wolfe Road
Cupertino, CA. 95014

Software Distribution Center
Digital Equipment Corporation
Maynard, Mass. 01754

PAPERBACKS GOOD STUFF ON COMPUTING FOR AGES 6 TO 60

For the crayon set:	"What is a Computer", (Houghton-Mifflin, Boston)
For Junior High:	"A Guided Tour of Computer Programming in BASIC", (Houghton-Mifflin, Boston, 02107)
For High School:	"A Computer Resource Book for Algebra", (Houghton-Mifflin, Boston, 02107)
For College:	"Computer Programming in BASIC", (John Wiley, N.Y. 10016)
For Anybody:	"My Computer Likes Me", (Dymax, Menlo Pk. 94025)